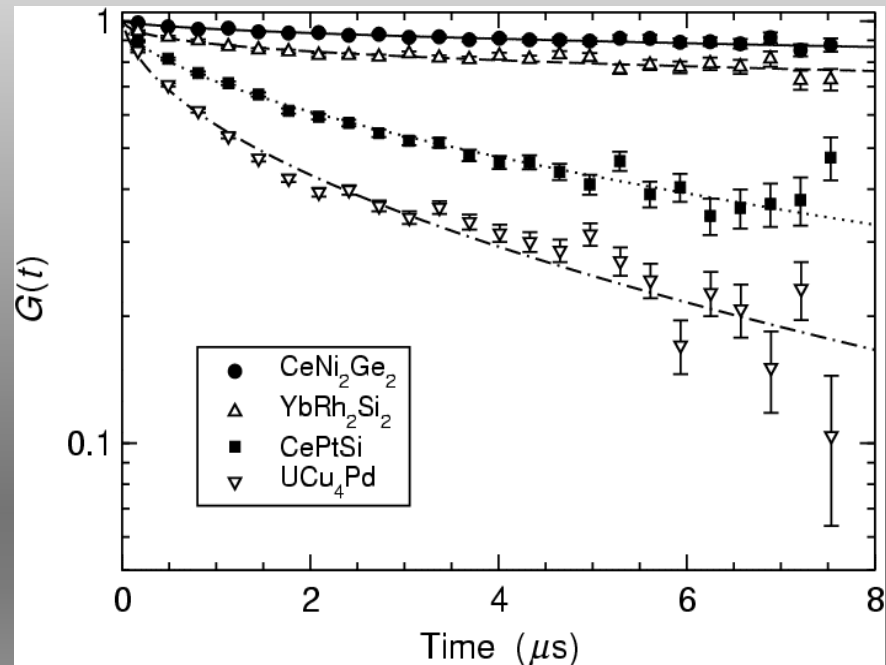


MAGNETIC RESONANCE STUDIES OF STRONGLY-CORRELATED ELECTRON METALS

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Non-Fermi liquids. There is widespread interest in a recently discovered class of alloys which exhibit unconventional properties at low temperatures because the standard "Fermi liquid" description appropriate to a conventional metal does not apply. (The "liquid" in this designation refers to the conducting electrons, which are free to move through the metal.)

Now Fermi liquid theory occupies a position somewhat similar to that of the Standard Model in particle physics: it is remarkably successful, so successful that it exercises considerable intellectual tyranny over our ways of thinking about metals! It is therefore a good thing that cases have been found where Fermi liquid theory manifestly breaks down.



The origin of this unconventional "non-Fermi liquid" (NFL) behavior is highly controversial. One school of thought interprets NFL properties as arising from a novel form of band electron scattering from the f ions in the metal. An opposing view invokes quantum critical behavior at zero temperature, controlled by interactions between f -ion spins. Our NMR and μSR studies of NFL alloys suggest that a third mechanism, related to structural disorder in the alloy, can also give rise to NFL behavior, a result which has also proved to be controversial. Our work and that of several theoreticians has shown, however, that disorder-driven NFL behavior is present and in at least some cases dominant in random alloys. The figure gives μSR relaxation curves for ordered (CeNi_2Ge_2 , YbRh_2Si_2) and disordered (CePtSi , UCu_4Pd) NFL alloys, showing that the relaxation function is subexponential (stretched exponential) and decays much faster for the disordered systems.

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Educational: 2 grad students; Work with undergrad. and summer students from U.S. and Canada at TRIUMF. Collaboration with colleagues in 4-yr and non-Ph.D.-granting institutions (Whittier College, Calif. State Univ. Los Angeles).

μ SR experiments are carried out at "meson factories", which produce intense beams of muons: the Paul Sherrer Institute, Switzerland (upper photo), and TRIUMF, Vancouver, Canada (lower photo). Students perform experiments at these institutes during beam-time periods of one to two weeks.

